Thirteenth Air Force

Integrity - Service - Excellence

One Health: Dynamics of Human-Animal Interactions

Douglas Riley, LtCol, USAF, DVM

Dynamics of Human-Animal Interactions

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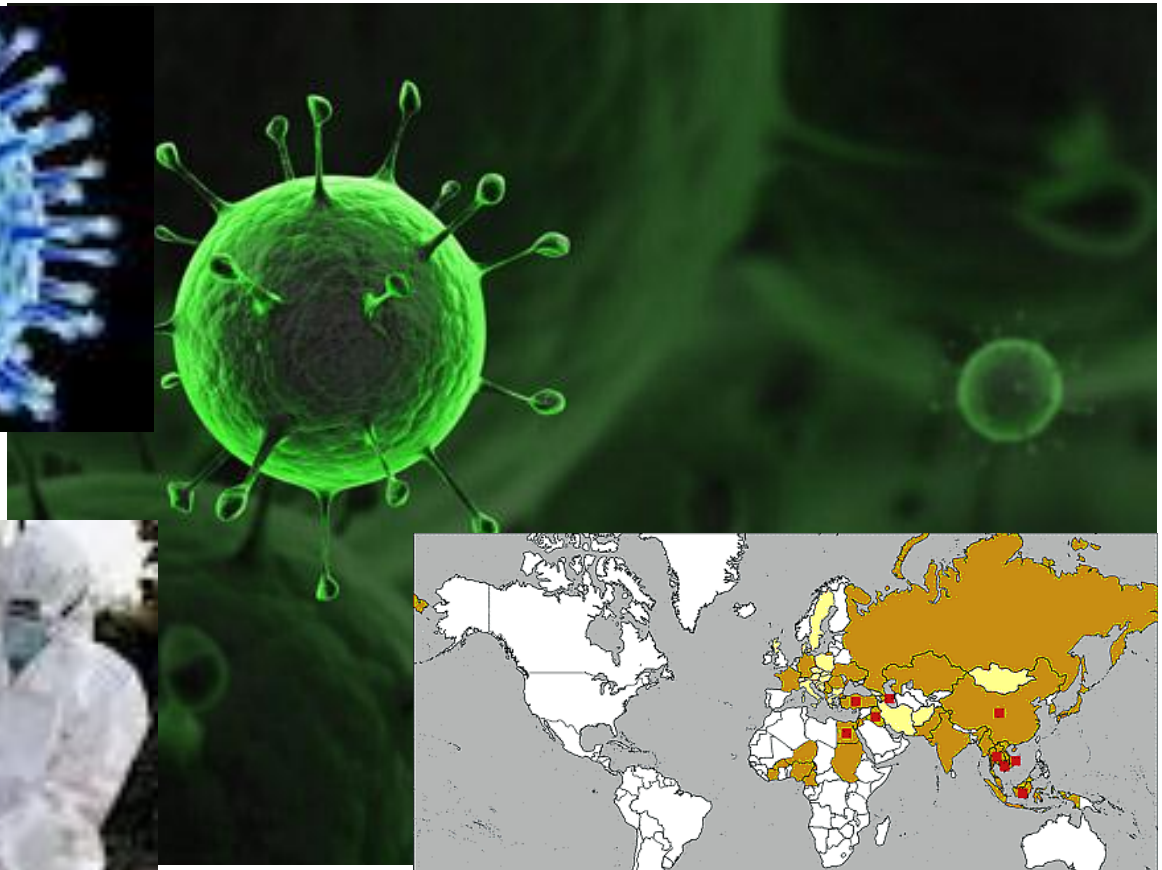
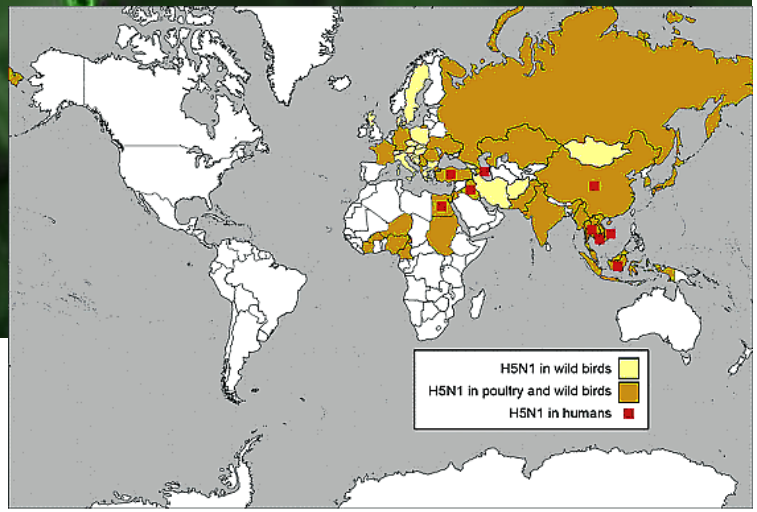
dipl AABP

A New Beginning

The Challenges

The Crossroads





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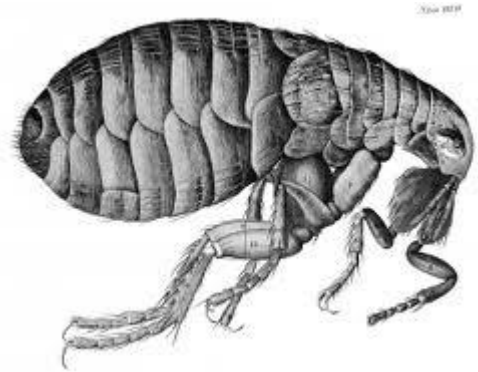
"One Medicine, One Health"

Arizona Biologist Dies of Plague

Phoenix, AZ Nov 9, 2007:

Eric York, a 37 year old biologist in Grand Canyon Park's cougar collaring program, died alone at home of proven pneumonic plague after a 2-3 day illness after **performing a necropsy on a cougar.**



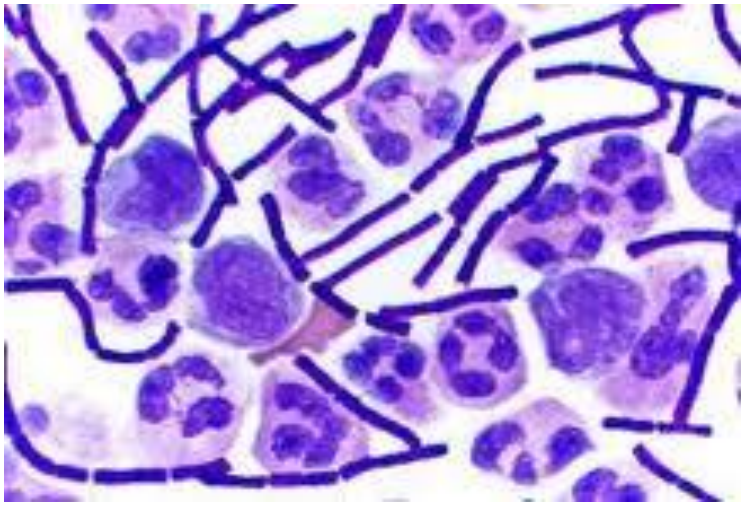
What is “One Health”?

- Integrating Human and Veterinary Medicine in selected endeavors
- Collaborations/Coalitions/Communication (MDs, DOs, DVMs/VMDs, PhDs, etc.)
- Synergistic efforts lead to improved health for both humans and animals.

Results of “One Health”

- Dramatic, rapid increase in scientific knowledge
- Improved medical education & clinical care
- Enhanced public health efficacy
- Accelerated biomedical research discoveries

Slide #4



Video

Bioterrorism Agents/Diseases

- **Category A**
  - **Anthrax** ***(Bacillus anthracis)***
  - **Botulism** ***(Clostridium botulinum*** **toxin*)***
  - **Plague** ***(Yersinia pestis)***
  - **Smallpox** ***(variola major)***
  - **Tularemia** ***(Francisella tularensis)***
  - **Viral Hemorrhagic fevers (filoviruses – Ebola and Marburg and arenaviruses – Lassa and Machupo)**

Bioterrorism Agents/Diseases

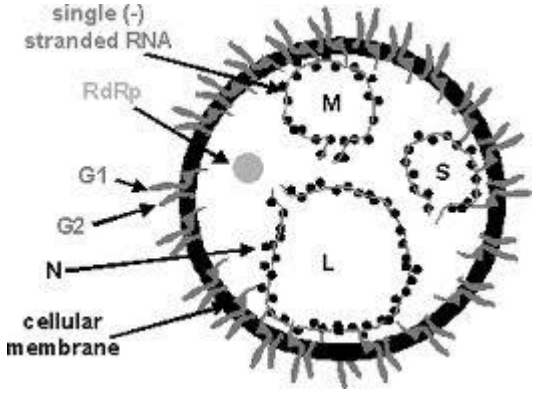
- **Category B**
  - **Brucellosis** (***Brucella*** **species)**
  - **Epsilon toxin of *Clostridium pefringens***
  - **Food safety threats** (***Salmonella*** **species, *E-coli, Shigella*)**
  - **Glanders** (***Burkholderia mallei*)**
  - **Melioidosis** (***Burkholderia pseudomallei*)**
  - **Psittacosis** (***Chlamydia psittaci*)**
  - **Q fever** (***Coxiella burnetii*)**
  - **Ricin toxin from *Ricinus communis* (castor beans)**
  - **Staphylococcal enterotoxin B**
  - **Typhus fever** (***Rickettsia prowazekii*)**
  - **Viral encephalitis – VEE, WEE, EEE**
  - **Water safety threats – *Vibrio cholera, Cryptosporidium parvum***

Bioterrorism Agents/Diseases

- **Category C**

Third highest priority agents include emerging pathogens that could be engineered for mass dissemination in the future because of:

- **Availability**
- **Ease of production and dissemination; and**
- **Potential for high morbidity and mortality rates and major health impact**



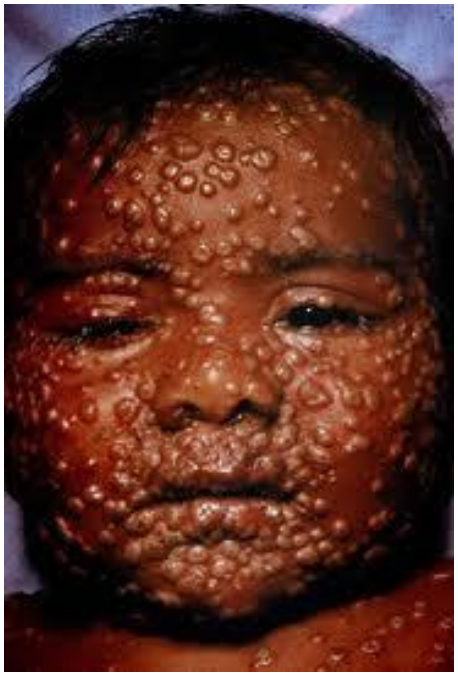
- **Such as:**
  - **Nipah virus and**
  - **Hantavirus**

Video

http://www.youtube.com/watch?v=7T8znKCoqHM&feature=player_embedded

Emerging and Re-emerging

- **Despite remarkable advances in medical research and treatments during the 20th century, infectious diseases remain among the leading causes of death worldwide.**



Small Pox

Plague

Anthrax

Emerging and Re-emerging

- Anthrax
- Antimicrobial Resistance
- Botulism
- Campylobacteriosis
- Dengue Fever
- Ehrlichiosis
- *E-Coli*
- Flu (influenza)
- Group A Streptococcal infections
- Hepatitis
- Lyme Disease

Emerging and Re-emerging

- Plague
- Prion Disease
- SARS
- Salmonellosis/Salmonella
- Shigellosis/Shigella
- Smallpox
- Tuberculosis
- Tularemia
- West Nile Virus

Zoonoses - Life Cycle

ORTHOZOONOSES

- May be perpetuated in nature by a single vertebrate species
- E.g. rabies, brucellosis, anthrax

Zoonosis: Rabies Life Cycle

Virus inoculation (bite)

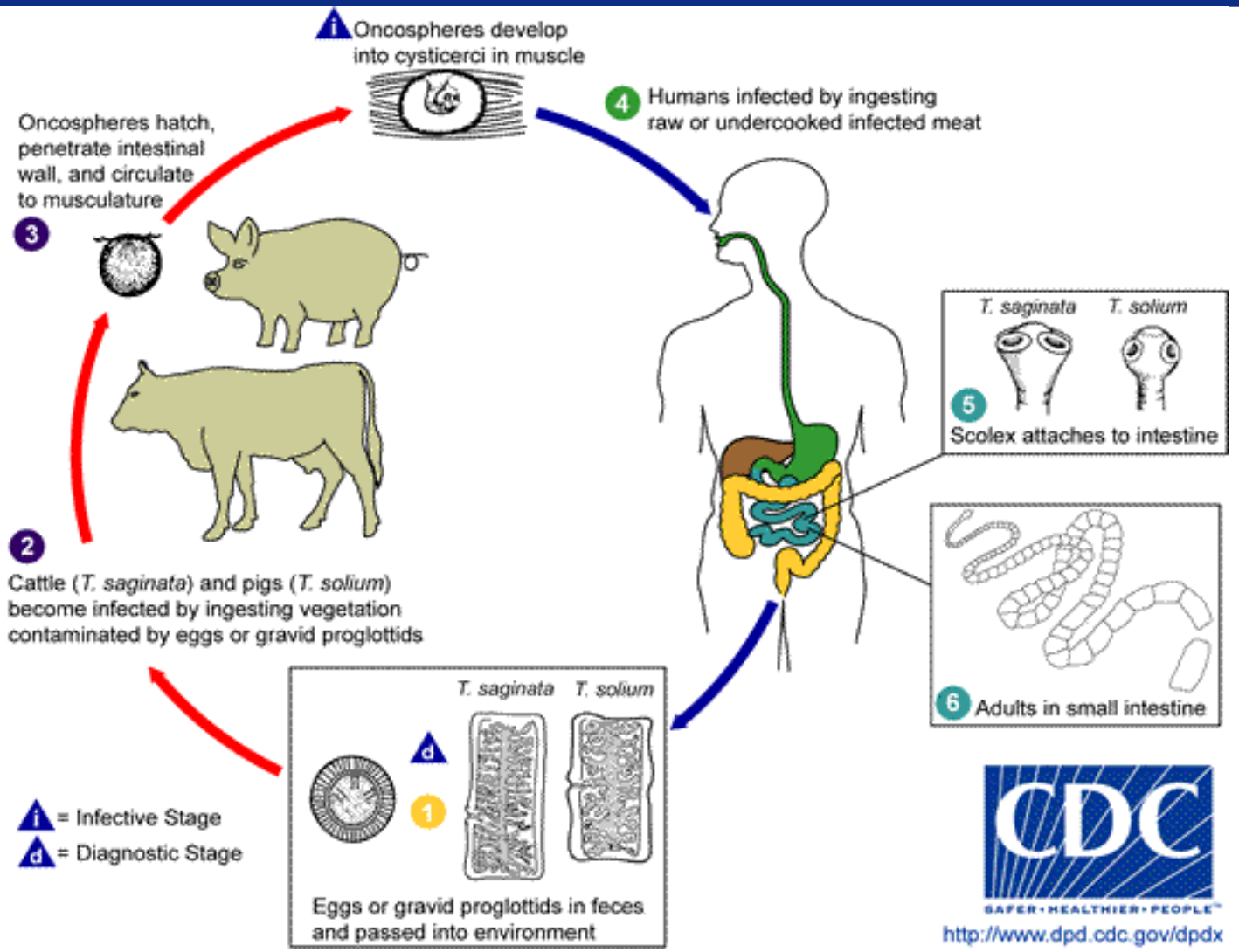
Salivary gland excretion

Zoonoses - Maintenance Cycle

CYCLOZOONOSES

- Requires more than one vertebrate species but no invertebrate host
- Most are cestodiases (tapeworm diseases)
  - *Taenia saginata* and *T. solium* require man to be one of vertebrate hosts
  - Others, such as hydatidosis, man is accidentally involved

Zoonoses - Maintenance Cycle



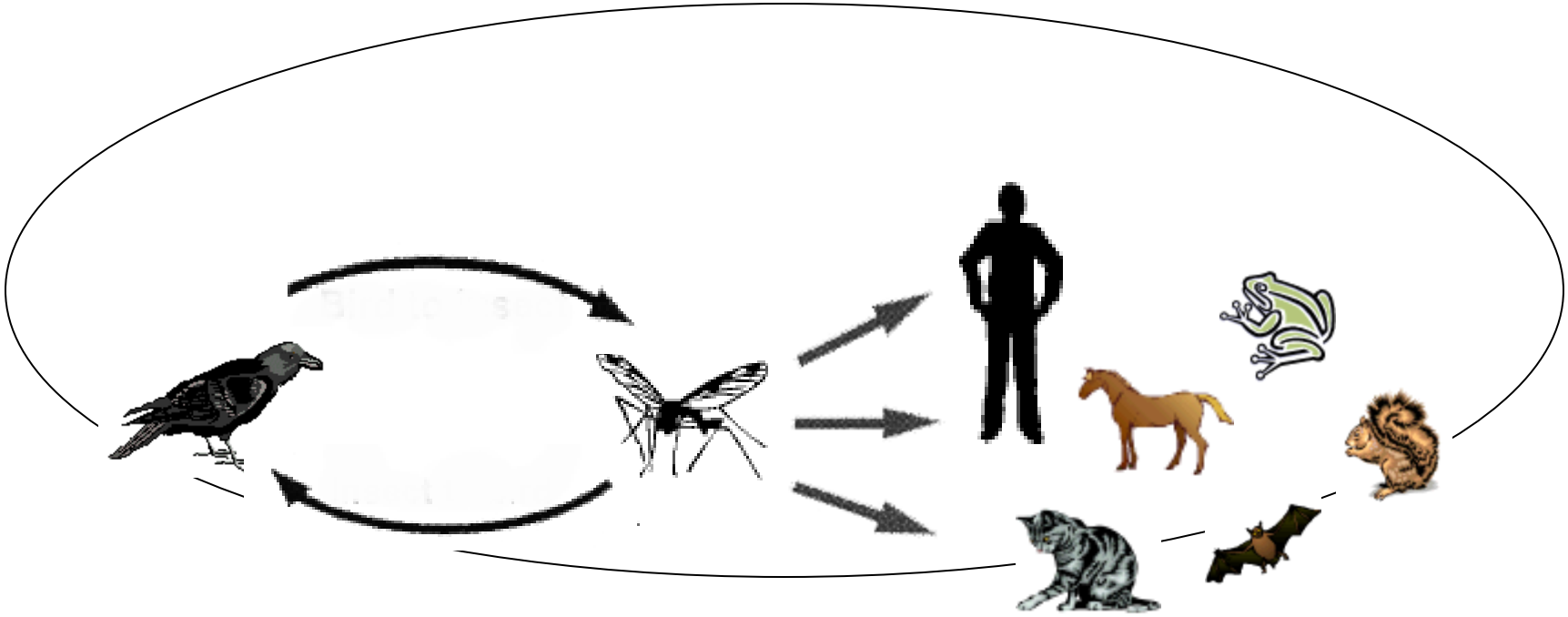
Zoonoses - Life Cycle

METAZOONOSES

- Require both vertebrates and invertebrates to complete transmission
- All arboviral infections
  - West Nile virus, Saint Louis encephalitis
- Some bacterial diseases
  - Plague, many rickettsia
- Some parasitic diseases
  - Leishmaniasis, schistosomiasis

Zoonoses: Metazoonoses

- **Invertebrate Host: Mosquitoes**
- **Vertebrate Host: Birds**
- **Incidental Hosts:**
  - **HUMANS, horses, amphibians, other mammals**



Current Status of "One Health"

- In the 20th century, human and animal diseases have been largely treated as separate entities.
- Physicians and veterinarians communicate and work together episodically.
- Ecology of microorganisms is generally not emphasized in medical schools while schools of veterinary medicine do.
- Medical students might not see the importance of zoonotic diseases and their impact on human and animal health.

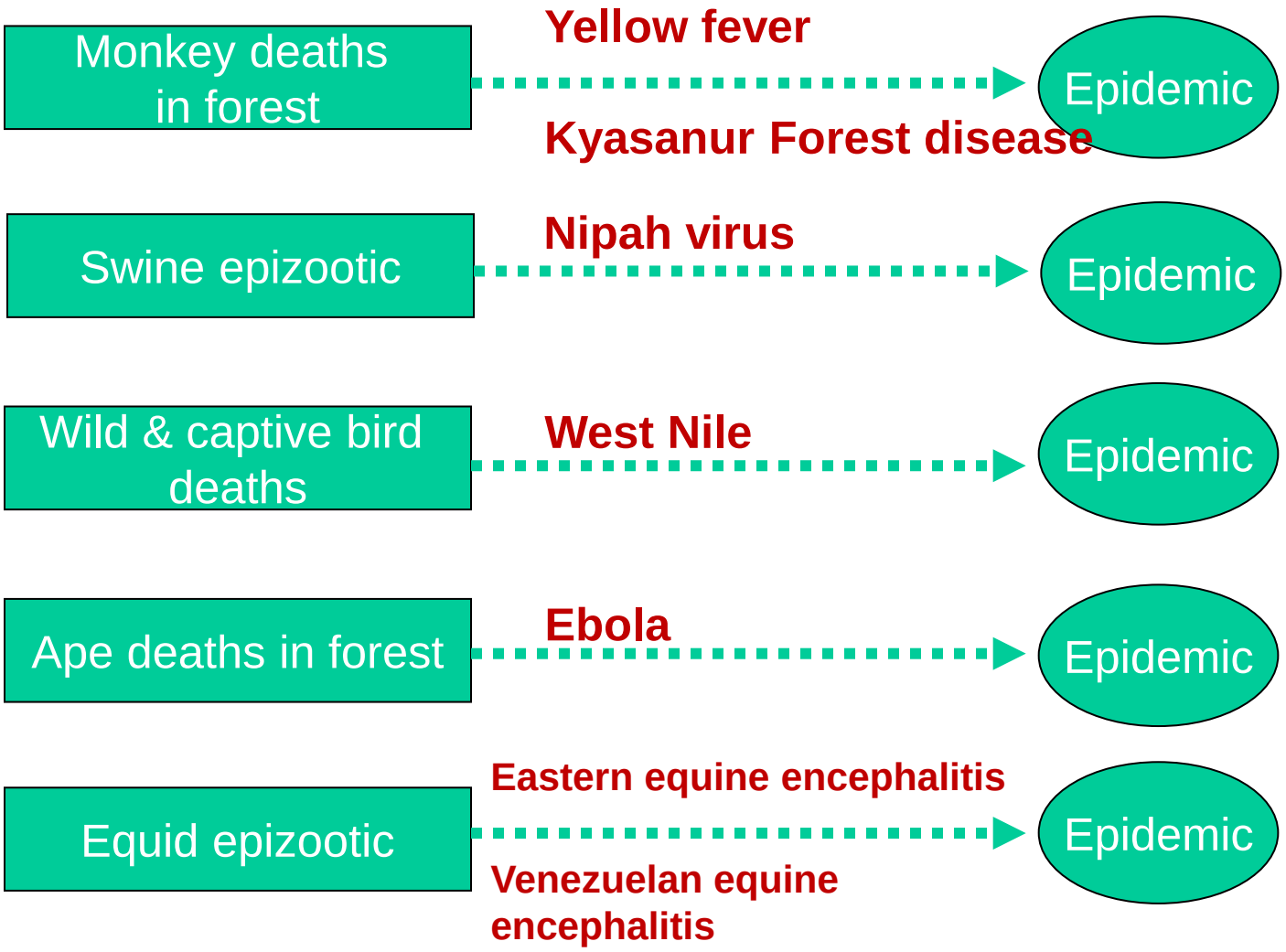
Additional movement forward

- CDC established a Center for Zoonotic, Vector Borne, and Enteric diseases in 2007 headed by a veterinarian, Dr. Lonnie J. King
- Society of Veterinary Tropical Medicine approved “One Health” resolution June 2007.
- Croatian Infectious Disease Society “One Health” Endorsement September 2007.
- American Society of Tropical Medicine and Hygiene Endorsement October 2007 & symposium November 2007.
- World Association of Veterinary Laboratory Diagnosticians Endorsement November 2007.
- Delta Society (Human-Animal bond) November 2007
- American Association of Veterinary Laboratory Diagnosticians

Some specific major potential outcomes of "One Health"

- **Integrated surveillance: improved early recognition and control of zoonoses with Syndrome Reporting Surveillance System (SYRIS)**
- **Integrated vaccination campaigns: improved coverage rates in third world nations**
- **Integrated biomedical research: improved development of diagnostics, therapeutics, devices**

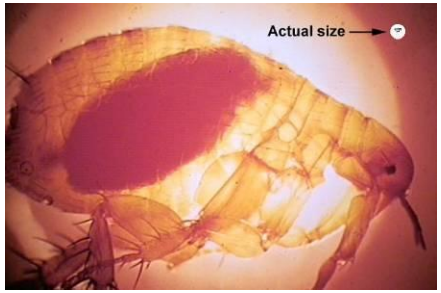
Examples of diseases that regularly emerge as animal pathogens in advance of human outbreaks



Division of Vector-Borne Infectious Diseases

Mosquito-borne diseases
- West Nile virus
- Equine encephalitides
- Dengue fever
- Yellow fever
- Japanese encephalitis
- Chikungunya

Flea-borne diseases
- Plague



Tick-borne diseases
- Lyme disease
- Tularemia
- Relapsing fever
- Encephalitis

Conclusions:

- The concept of “One Health,One Medicine” has been around for several centuries.
- Collaboration was considerable in the 18th and 19th centuries. It languished in the 20th century.
- The challenges of the 21st century demand that the different professions work together so we can reinvigorate “One Health”.
- Implementation will protect and/or save untold millions of lives during our generation and in future generations!

Example-”Amercia”

The Index Case

Compounding factors

The Hypothetical Disease

- *Amercia* is a novel virus – resulting from poor animal management
- The human population is naive to the virus
- Morbidity rates are upward of 100%
- Mortality rates are at 60% in developed countries
- Incubation period is 7-10 days
- Disease is communicable/infectious on day 4 – prior to symptoms
- Death occurs 3 weeks after clinical signs
- This is a highly virulent virus that kills all cells it comes into contact with and vaccine production is very difficult

Symptoms and other supporting data

- **Flu Like Symptoms with rapid cardiovascular collapse resulting in death**

- **Suspected R value of 4 – similar to that of Polio before a vaccine was produced**

Questions